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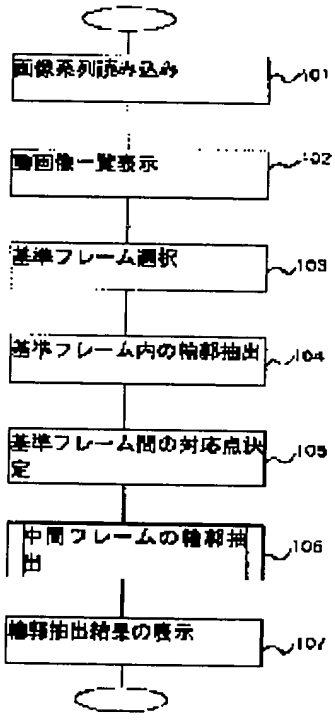
(54) METHOD FOR EXTRACTING OUTLINE OF DYNAMIC IMAGE

(57)Abstract:

PROBLEM TO BE SOLVED: To surely and efficiently extract the outline of the image of a rapidly moving object from a dynamic image.

SOLUTION: When a user selects two discontinuous reference frames from a picture in plural frames displayed as a list on a display (103), each outline of the image of an object is extracted from the picture in each reference frame (104). When the user indicates the proper number of characteristic points on the outline of the image of the object in the image in each reference frame, and makes them correspond to each other (105), the outline of the image of the object in an intermediate frame between the two reference frames is presumed from the coordinates of the characteristic points in the image in each reference frame (106). Then, this is used as an outline for starting retrieval. Then, the retrieval of the image in each intermediate frame is started from the retrieval starting outline, and the actual outline of the image of the object is extracted.



LEGAL STATUS

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[Date of final disposal for application]

[Patent number]

[Date of registration]

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* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the picture extraction method that the border line of the picture of the intense move body of movement can be certainly extracted out of a dynamic image.
[0002]
[Description of the Prior Art] Let it be fundamental technology to extract the field of an analysis object from a dynamic image in the dynamic image analysis used widely in various fields, such as medicine and meteorology. Generally such technology is called picture segmentation technology, and the boundary detection which extracts the border line of the picture of an analysis object is known by using the changing point of the features (for example, luminosity etc.) of a picture as an edge and connecting [detect, emphasize and] as the way method. this Boundary Detection -- being Related -- Computer Vision, Prentice-Hall, and Inc. -- it is Indicated by 1982 "Chapter 4 Boundary Detection" (D. H.Ballard, C.B.Brown Work) The edge detection which mentions as an example the case where the monochrome static image f (x y) is made into an object picture, and is hereafter indicated by this about the edge detection characteristic of this kind of technique is explained.
[0003] It asks for the large place of the color between the pixels adjoined in a picture, or the difference of picture concentration as an edge fundamentally, and asks for a profile by connecting this. Here, the word "edge" is a segment in a certain meaning which exists in a picture, and a profile becomes a closed contour, when the body showing the appearance of the body which exists in a picture does not hide into a picture but is showing. Many edges exist also on a profile besides it. Moreover, in the technique of a usual image processing conversely like the edge-detection operator who states later, not all on a profile are recognized as an edge.
[0004] Being used in order to ask for an edge is as follows.
[0005] In the case of monochrome shade picture, i and j pixels are expressed with a (i, j). The direction of i corresponds to a longitudinal direction, and the direction of j corresponds to lengthwise.
[0006] Primary differential longitudinal direction : (1) a(i+1, j)-a (i, j), lengthwise:a(i, j+1)-a (i, j), square [of absolute value: (a(i+1 j)-a (i, j))] ((2) quadratic-differential longitudinal direction:, such as a square root of the square [of a(i, j+1)-a (i, j)] sum, -- a(i+1, j)-2a(i, j)+a (i-1, j) --) Lengthwise: The sum of the last both directions may be especially called Laplacian here [, such as sum:a(i+1, j)+a(i-1 j)+a(i, j+1)+a(i, j-1)-4of a(i, j+1)-2a(i, j)+a (i, j-1) and both directions a (i, j),]. This Laplacian **2 It is computed in fact by the convolution operation using the operator of the three-line three trains shown below.
[0007]

0	1	0
1	-4	1
0	1	0

That is, Laplacian **2 will be expressed like the following formula as consequent.
[0008]
**2 =a(x y-1)+a(x-1, y)-4a (x y)
+ a(x+1, y) +a (x y+1) -- (formula 1)
In addition, as an operator who uses for the convolution operation performed in the case of an edge detection, the thing of three-line three trains may necessarily be used, and the thing of a n line m train (n and m are the natural number) may be used.
[0009] By the way, the edge detected by such technique has many way piece ****** cases by the influence of noise etc. Then, above Computer Vision Prentice-Hall Inc. -- in order to Connect ******** Edge Smoothly, Using the Edge Pursuing Method is Indicated by 1982 "Chapter 4 Boundary Detection" (D. H.Ballard, C.B.Brown Work) (P. 131 to P.137 Reference)
[0010] As edge detections other than this, the picture segmentation method given in JP,7-121710,A is learned, for example. This Picture Segmentation Method Has the Feature in Receiving Specification of Search Start Pixel on Profile of Picture of Analysis Object, and Specification of Direction that Edge Search is Advanced, from User Side unlike Edge Detection above Computer Vision, Prentice-Hall, and Given in Inc.1982 "Chapter 4 Boundary Detection" (D. H.Ballard, C.B.Brown Work). In addition, it is also characteristic that a user can extract as an edge the border line which drew with the mouse etc. according to directions of a user. that is, automatic extracting only of the edge of the analysis object from the picture in which the edge became intricate certainly and intricately efficiently [be / it / more markedly / than the case where edge search is arbitrarily advanced since a user can determine the edge of an analysis object intentionally when that a user gives the indicator of edge search intentionally fails in connection of an edge on ****** / alike and] can be carried out
[0011] By the way, when detecting the edge of an analysis object from a dynamic image, technique is not applied like the edge detection in the above-mentioned static image about all the frames that constitute a dynamic image. In order to process a vast quantity of data efficiently, usually "SNAKES:Active Contour Models" (M. Kess, A.Witkin, D.Terzopoulos) International Journal of Computer Vision and vol.1 No. -- 4 and 1988 As indicated Although the edge of an analysis object is detected according to the same technique as the edge detection in the above-mentioned static image only from the frame of the beginning of the frames which constitute a dynamic image The technique of detecting the edge of an analysis object is adopted by performing edge search about the frame which continues after that by making into a search start point the edge of the analysis object extracted from the last frame.
[0012]
[Problem(s) to be Solved by the Invention] However, the technique adopted when detecting the edge of an analysis object from the above-mentioned dynamic image had the fault that detection of the edge of the intense analysis object of movement could not be coped with. That is, if the movement of an analysis object is intense, since the position of an analysis object is remarkably different mutually in many cases in a continuous frame, the edge of an analysis object cannot necessarily be detected for the edge of the analysis object extracted from the last frame as a search start point.
[0013] Then, this invention aims at offering the dynamic-image extraction method that the picture of the intense move body of movement can be extracted certainly and efficiently out of a dynamic image.
[0014]
[Means for Solving the Problem] In order to solve the above-mentioned technical problem, this invention is the picture extraction method of extracting the border line of an objective picture from the picture of two or more frames one by one. The first step which receives specification of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of two criteria frames which are not followed of two or more aforementioned frames, It is based on the position of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of each aforementioned criteria frame. The second step which computes the search start line which starts search of the border line of the picture of the aforementioned body in the picture of the intermediate frame pinched by two aforementioned criteria

frames, respectively, In the picture of the intermediate frame pinched by two aforementioned criteria frames, search of the border line of the picture of the aforementioned body is started from the aforementioned search start line, and the picture extraction method characterized by including the third step which extracts the border line of the picture of the aforementioned body one by one is offered.
[0015]
[Embodiments of the Invention] Hereafter, one gestalt of operation concerning this invention is explained, referring to an attached drawing.
[0016] First, drawing 1 explains the basic composition of the hardware of the image processing system concerning the gestalt of this operation.
[0017] The input unit with which this image processing system receives the input from a user, The picture input device 308 which inputs digital dynamic-image data for every frame, The display unit 305 which displays a dynamic image (for example, a CRT monitor, a liquid crystal display, etc.), The auxiliary memory 307 which stores the various programs which defined data processing performed by the after-mentioned digital dynamic-image data [which were inputted from the picture input device 308], and segmentation processing, The processor 301 which performs the below-mentioned segmentation processing, and the buffer memory 302 for processor 301, The frame memory 303 for processor 301, and the input/output control processor 306 which connects auxiliary memory 307, a picture input device 308, and an input unit 310,309 to a processor 301, It has the display controller 304 who changes into an RGB code the image data stored in the frame buffer 303, and outputs to a display unit 305, and the system bus 311 which connects these each part mutually.
[0018] The display unit 305 which displays a dynamic image has the property (namely, each red bluish green a 1000x1000-pixel display, 256 gradation, 16,700,000 color displays) made general as this kind of a display unit. When using other display units which have a different property from this instead of this, it is desirable to change picture I/O device 308 used now into other picture input devices which have the performance in which it can respond to the property of a new display unit if needed.
[0019] The input unit which receives the input from a user consists of mouse 310 grades which receive specification of the arbitrary positions on the keyboard 309 which receives selection of the function assigned to each key, and the screen screen of a display unit 305.
[0020] Therefore, after the user moved the cursor currently displayed on the screen screen of a display unit 305 using the mouse 310, Furthermore, the button carried in the mouse 310 (with the gestalt of this operation) Out of two or more frames (refer to drawing 5) which constitute the dynamic image by which it was indicated by the list from a state where it stood in a line on the screen screen of a display unit 305 by clicking the predetermined button of the two buttons at time series The frame which constitutes a desired scene can be specified (after-mentioned). Hereafter, the mouse operation by the user at this time is called "pick by the mouse 310." Moreover, the state where the button carried in the mouse 310 is pushed will be called "mouse-on state", and this will call "mouse-off state" the state where the button conversely carried in the mouse 310 is not pushed.
[0021] In addition, although the mouse 310 is used with the gestalt of this operation as an input unit for specifying the position on the screen screen of a display unit, it is not necessary to necessarily use a mouse and other locator equipments (for example, joy stick etc.) may be used as substitution of a mouse 310. Moreover, it is desirable for it not to be necessary about the operating instruction of a mouse 310 to adopt an operating instruction as explained here, and to adopt the operating instruction which added a suitable change in consideration of a user's operability.
[0022] Moreover, a user can input the numeric value assigned to each key, the command which directs program execution by choosing a suitable key out of the key of a keyboard 309.
[0023] The field 401 which memorizes predetermined data with starting of a system as shown in the buffer memory 302 for processor 301 at drawing 2 , i.e., the program field which memorizes the predetermined program stored in auxiliary memory 307, the operating system field (un-illustrating) which memorizes the various programs which constitute an operating system, and the data area 402 which memorizes the various data needed in the below-mentioned segmentation processing are secured.
[0024] And each field included to the program field 401 The field 403 which memorizes the whole

control program which defined the flow of the below-mentioned segmentation processing, respectively, The field 404 which memorizes the criteria frame profile extraction program which defined the criteria frame profile extraction processing performed by below-mentioned segmentation being under processing, The field 406 which memorizes the profile search program which defined the profile search processing performed by below-mentioned segmentation being under processing, It is assigned as a field 405 which memorizes the search start profile calculation program which defined the search start profile calculation processing performed by below-mentioned segmentation being under processing.
[0025] On the other hand, each field included in the data area 402 is digital dynamic-image data () stored in auxiliary memory 307, respectively. Or the dynamic-image data area 407 which memorizes the digital dynamic-image data inputted from the picture input device 308 and the border-line data area 408 which memorizes the border-line data extracted by profile search processing performed by below-mentioned segmentation being under processing, It is assigned as the kernel pattern field 409 which memorizes the differential type operator used for the convolution operation of an edge detection, and a working area 410 which memorizes temporary data created in the below-mentioned segmentation processing.
[0026] Above, the explanation about the composition of the hardware of the image processing system concerning the gestalt of this operation is finished. In addition, as the processing section equivalent to a processor 301, buffer memory 302, and an input/output processor 306, although the information processor (a workstation, personal computer) of a stand-alone type is used, it is not necessary to necessarily do in this way with the gestalt of this operation. For example, a network system constitutes this image processing system, and it may be made to perform data processing in the below-mentioned segmentation processing etc. in parallel with many computer resources. Moreover, it is not necessary to necessarily use the information processor used with the gestalt of this operation and the information processor of architecture of the same kind, i.e., the information processor of single bus architecture with which a processor 301, buffer memory 302, and an input/output processor 306 share one system bus. For example, you may use the information processor which connected between a processor 301 and input/output processors 306 by the individual system bus between a processor 301 and buffer memory 302, respectively.
[0027] The segmentation processing which a processor 301 performs by drawing 3 and drawing 4 hereafter according to the whole control program memorized to the field 403 of buffer memory 302 is explained.
[0028] If a user inputs a predetermined command using an input unit, the segmentation processing shown in drawing 3 will be started. That is, in Step 101, if the digital dynamic-image data (or digital dynamic-image data inputted from the picture input device 308) stored in auxiliary memory 307 are memorized by the dynamic-image data area 407 of buffer memory 302, a display controller 304 stores this in a frame buffer 303, after performing a predetermined image processing to the digital dynamic-image data memorized by the dynamic-image data area 407 of buffer memory 302 at this time. And after changing into an RGB code the digital dynamic-image data stored in the frame buffer 303, it outputs to a display unit 305.
[0029] Consequently, in Step 102, on the screen screen of a display unit 305, as shown in drawing 5 , a list indication of the picture of the frame which constitutes a dynamic image is given in the state where it ranked with time series. In addition, as long as it is the case where it is not necessary to necessarily display the picture of all the frames that constitute a dynamic image for example, and the body with comparatively blunt movement is being used as the main photographic subjects, you may be made to indicate the picture in every several frames by list.
[0030] Then, in Step 103, if a user specifies the picture of the head frame F1 of a desired scene, and the tail frame Fn, respectively out of the picture of the frame by which it was indicated by the list on the screen screen of a display unit 305 with "the pick by the mouse 310", the head frame F1 and the tail frame Fn which were specified at this time will be set up as a criteria frame. then, in Step 104, a processor 301 performs the edge detection explained in the column of the conventional technology using the differential type operator memorized at the criteria frame profile extraction processing 409, i.e., the

kernel pattern field of buffer memory 302, according to the criteria frame profile extraction processing program memorized to the field 404 of buffer memory 302, and extracts the border line which is the picture of Body B from the picture of two criteria frames F1 and Fn, respectively in addition, the need that criteria frame profile extraction processing is not necessarily based on the edge detection explained in the column of the conventional technology may be field division which there is not, for example, is known as other way methods of segmentation technology And the border-line data showing the border line of the picture of the body B extracted from the picture of two criteria frames F1 and Fn are memorized to the border-line data area 408 of buffer memory 302, respectively. Then, after a display controller 304 compounds the border-line data showing the border line of the picture of the body B extracted from the picture of two criteria frames F1 and Fn, and the image data showing the picture of two criteria frames F1 and Fn, respectively, he performs the same processing as Step 102, and outputs to a display unit 305. Consequently, on the screen screen of a display unit 305, the picture of the criteria frames F1 and Fn which gave a synthetic indication of the border lines B1 and Bn of the picture of the newly extracted body B is displayed.

[0031] As shown in drawing 6 , a user in Step 105 then, with "the pick by the mouse 310" In the picture of two criteria frames F1 and Fn, only the suitable number (n-1) points to the border line B1 of the picture of Body B, the focus on Bn (A1, ..., An), and (N1, ..., Nn), respectively. If each focus (A1, N1), ..., (An, Nn) are matched mutually, it will set to Step 106. a processor 301 Recursive processing shown in drawing 4 is performed, and the border line of the picture of Body B is extracted from the intermediate frame F3 between two criteria frames F1 and Fn, ..., the picture of Fn-1 one by one. Namely, a processor 301 performs the following processings one by one by making each intermediate frame F2, ..., the picture of Fn-1 into a processing-object picture.

[0032] In Step 201 first, a processor 301 Search start profile calculation is performed according to the search start profile calculation program indicated to the field 405 of buffer memory. The coordinate of each focus K1, ..., Kn on the border line of the body B contained in the picture of the k-th intermediate frame Fk which is a new processing object is presumed. furthermore, between each presumed focus K1, ..., Kn -- digital ones -- a segment -- it describes and considers as the search start border line 702 which should make this the origin which searches for the border line of Body B in the picture of an intermediate frame Fk (refer to drawing 7) Specifically, as shown below, according to a formula 2, the coordinate (Xt, Yt) (however, 1<t<n) showing the position of each focus K1, ..., Kn on the profile of the body B contained in the picture of the k-th intermediate frame Fk is presumed first.

[0033]

(Xt, Yt) ={(n-k) (X't, Y't)+ (k-1)
(X"t, Y"t)}/(n-1) -- (formula 2)

It is the coordinate which expresses the position of each focus (A1, N1) corresponding to mutual, ..., (An, Nn) between here and (X't, Y't) (X"t, Y"t) (however, 1<t<n) the profile of the body B contained in the picture of two criteria frames F1 and Fn.

[0034] In the picture of two criteria frames F1 and Fn, respectively furthermore, by the edge detection Two points are set in the picture of the k-th intermediate frame Fk using the coordinate of AAs and NNs, and a formula 2. the adjoining focus (As, As-1), the border line B1 between (Ns, Ns-1), and the points AAs and NNs on Bn -- extracting -- this -- The coordinate of the focus Ks adjoined on the border line of the picture of Body b and the point (it is hereafter called a midpoint) between Ks-1 is presumed. And such processing is repeated, and in order to create a reliable search start border line, the coordinate of the midpoint of sufficient number is presumed. In addition, with the gestalt of this operation, seven midpoints were presumed for every adjoining focus Ks and Ks-between in consideration of the adjoining focus Ks, the interval of Ks-1, etc.

[0035] then, digital one of common knowledge, such as a DDA (digital differential analyzer) algorithm, -- a segment -- according to a depiction algorithm, between Focus K1, ..., Kn and the midpoints which were presumed is drawn, respectively, and let this be the search start profile 702 in the picture of the k-th intermediate frame Fk (refer to drawing 7) In addition, the DDA algorithm mentioned as an example here is simplest algorithm as an algorithm which draws between dispersed points in digital one, and is

indicated by 3 [besides Computer Graphics-principles and practice- and Addison-Wesley 1990 J.D.Foley] excellent book (p73 -p74) about the detail.

[0036] Then, a processor 301 performs profile search processing in Step 202 according to the profile search program memorized to the field 406 of buffer memory. That is, in the picture of the k-th intermediate frame Fk, the point which exists really the search start point set up for every interval suitable on the search start profile 702 computed at Step 201 on the border line Bk of the picture of the actual body B from the picture of the k-th intermediate frame Fk by performing an edge detection as an origin of 1 is extracted. in addition, "SNAKES:Active Contour Models" (M. Kass, A.Witkin, D, Terzopoulos) Intwernational Journal of ComputerVision explained in the column of the conventional technology as an edge detection performed at this time, for example and vol.1 No. -- what is necessary is just to adopt the well-known technique, such as technique, like the edge search method indicated by 4 and 1988 And same processing is performed about all search start points, respectively, and the point which exists really on the border line of the picture of the border line of Body B is extracted one by one. And between the extracted points is drawn according to well-known drawing algorithms, such as a DDA (digital differential analyzer) algorithm, and let this be the border line Bk (to refer to drawing 7) of the picture of the border line of the body B contained in the picture of the k-th intermediate frame Fk. And the border-line data showing this border line Bk are memorized to the border-line data area 408 of buffer memory 302.

[0037] A processor 301 performs recursive processing shown in drawing 2 . now, from all the intermediate frames F2, ..., Fn-1 If it finishes extracting the border line B3 of the picture of the border line of Body B, ..., Bn-1, it will set to Step 107, respectively. a display controller 304 The border-line data showing the border line of the picture of the body B extracted from the picture of each frames F1, ..., Fn memorized by the border-line data area 408 of buffer memory 302, every -- after compounding F1, ..., the image data showing the picture of Fn, respectively, the same processing as Step 102 is performed, and it outputs to a display unit 305 Consequently, on the screen screen of a display unit 305, a list indication of the picture of each frames F1 and Fn by which the border lines B1, ..., Bn of the picture of Body B were compounded is given in the state where it ranked with time series.

[0038] Thus, since the border line of the picture of the body contained in the picture of an intermediate frame is presumed from the border line of the picture of the body contained in the picture of two criteria frames and this is made into the origin of the search in the picture of each intermediate frame, as shown in drawing 7 , in the picture of each intermediate frame, search can be started from the position near the **** of the border line of the picture of an actual body, respectively. That is, even if it is the intense body of movement, the border line of the picture can be extracted efficiently and certainly.

[0039] Above, the explanation about the segmentation processing concerning the gestalt of this operation is finished.

[0040] In addition, with the gestalt of this operation, although two frames are set up as a criteria frame, it is not necessary to necessarily do in this way. For example, when objective movement changes, a criteria frame is further set up into an intermediate frame, and it may be made to perform the above-mentioned segmentation processing for every scene which has regularity in objective movement.

[0041] Moreover, although drawing by the DDA algorithm is used with the gestalt of this operation in case the objective border line and objective search start profile of a picture are computed, you may use the digital alignment drawing algorithm which does not need to use this, for example, not necessarily draws a spline curve in digital one. When setting up three or more criteria frames, a suitable multi-term function with a degree lower the first order than the number of sheets of a criteria frame is created, and you may make it use this as a interpolation function.

[0042] In addition, a dynamic image may be what photos the same body simultaneously from a different direction from a different position using two or more cameras, and compounded and created this.

[0043]

[Effect of the Invention] According to the dynamic-image extraction method concerning this invention, the border line of the picture of the intense body of movement can be extracted from a dynamic image efficiently and certainly.

[Translation done.]

NOTICES *

1. This document has been translated by computer.So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The picture extraction method characterized by providing the following of extracting the border line of an objective picture from the picture of two or more frames one by one. The first step which receives specification of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of two criteria frames which are not followed of the frames of front plurality. The second step which computes the search start line which starts search of the border line of the picture of the aforementioned body in the picture of the intermediate frame pinched by two aforementioned criteria frames based on the position of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of each aforementioned criteria frame, respectively. The third step which starts search of the border line of the picture of the aforementioned body from the aforementioned search start line in the picture of the intermediate frame pinched by two aforementioned criteria frames, and extracts the border line of the picture of the aforementioned body one by one.
[Claim 2] The picture extraction method characterized by providing the following of extracting the border line of an objective picture from the picture of two or more frames one by one. The first step which receives specification of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of two or more criteria frames which are not followed of the frames of front plurality. The second step which computes the search start line which starts search of the border line of the picture of the aforementioned body in the picture of the intermediate frame pinched by the criteria frame of order based on the position of two or more focus on the border line of the picture of the aforementioned body corresponding to mutual between the pictures of the criteria frame of order, respectively. The third step which starts search of the border line of the picture of the aforementioned body from the aforementioned search start line in the picture of the intermediate frame pinched by the criteria frame of order, and extracts the border line of the picture of the aforementioned body one by one.
[Claim 3] The picture extraction method according to claim 2 characterized by providing the following. The second step of the above is two or more focus on the border line of the picture of the aforementioned body contained in the picture of the criteria frame of 1. the N which is the number of the intermediate frames into which between two or more focus on the border line of the picture of the aforementioned body contained in the next criteria frame of the criteria frame of the above 1 corresponding to each focus of two or more aforementioned focus was inserted between the criteria frame of the above 1, and the next criteria frame of the criteria frame of the above 1, respectively -- 1 -- the step which computes the internally dividing point which divides into the individual which are many numbers (N+1) Two or more focus on the border line of the picture of the aforementioned body contained in the picture of the criteria frame of the above 1 of the aforementioned internally dividing points. About between two or more focus on the border line of the picture of the aforementioned body contained in the next criteria frame of the criteria frame of the above 1 corresponding to each focus of two or more aforementioned focus, it is J. : (N-J +1) (J) The step which makes the line which

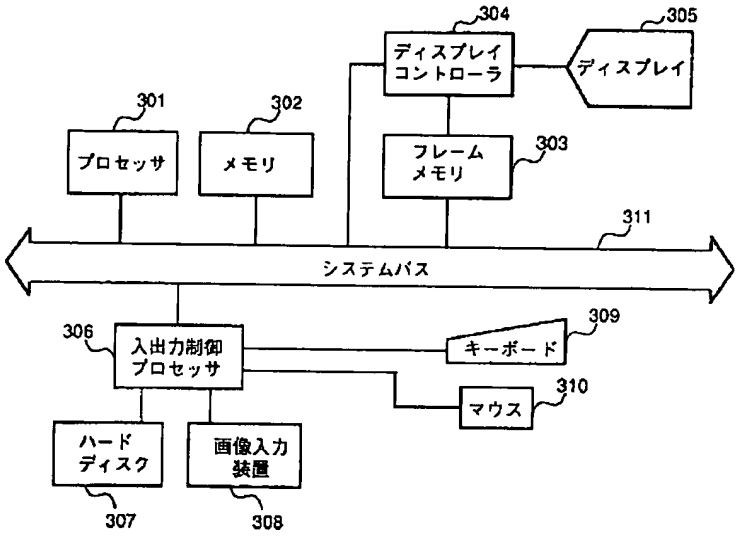
interpolated and obtained between the internally dividing points currently divided into the natural number below N using the predetermined interpolation function the search start line of the intermediate frame Jth after the criteria frame of the above 1.
[Claim 4] It is the picture extraction method that it is the picture extraction method according to claim 3, and the aforementioned predetermined interpolation function is characterized by being the multi-term function of a low degree [primary] rather than the number of the aforementioned criteria frames.
[Claim 5] It is the picture extraction method which is the picture extraction method according to claim 3, and is characterized by the aforementioned predetermined interpolation function being a spline function.

[Claim 6] It is the picture extraction method characterized by being the picture extraction method according to claim 1, 2, 3, 4, or 5, and two or more aforementioned frames being constituted by the frame which photoed the aforementioned body from arbitrary positions and arbitrary directions using two or more cameras.

[Translation done.]

Drawing selection drawing 1

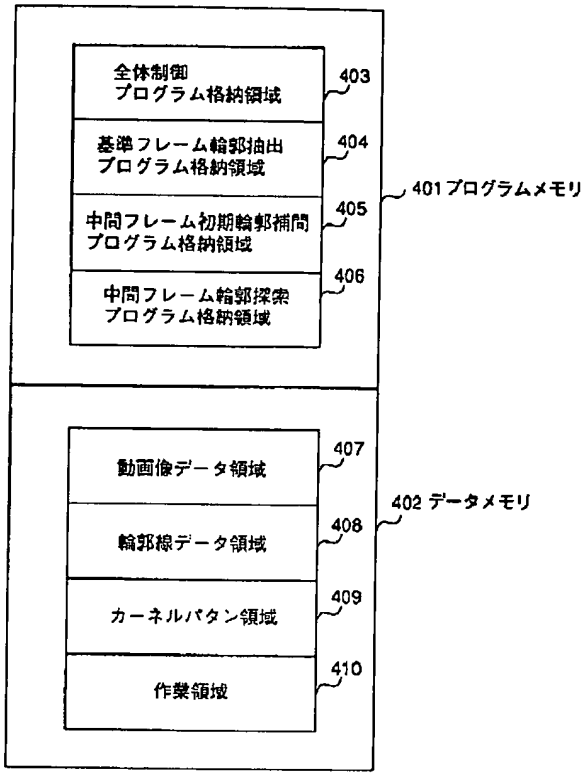
図1



[Translation done.]

Drawing selection drawing 2

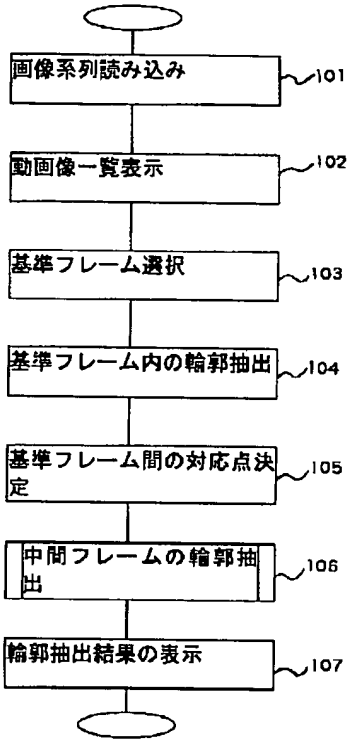
図 2



[Translation done.]

Drawing selection drawing 3

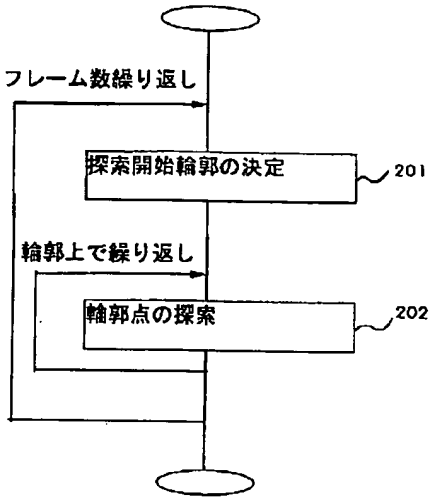
図3



[Translation done.]

Drawing selection drawing 4

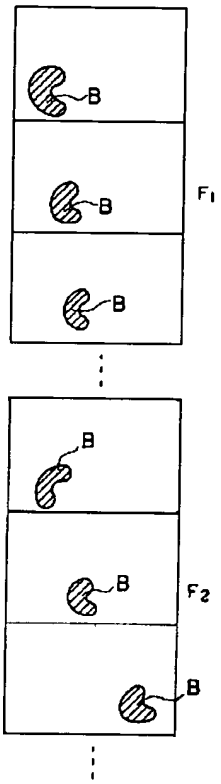
図4



[Translation done.]

Drawing selection drawing 5

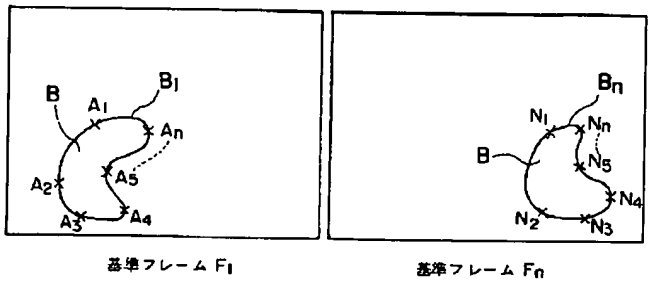
☒ 5



[Translation done.]

Drawing selection drawing 6

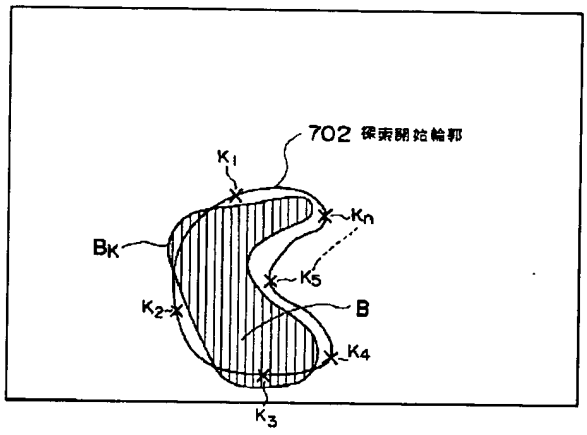
図 6



[Translation done.]

Drawing selection drawing 7

図 7



中間フレーム F_K

[Translation done.]

THOMSON DERWENT

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(57)【要約】

(57)[SUMMARY]

【課題】
動画像から、動きの激しい物体の画像の輪郭線を確実に且つ効率的に抽出する。

[SUBJECT]
The contour_line of the image of a rapidly moving object is extracted from a dynamic image reliably and efficiently.

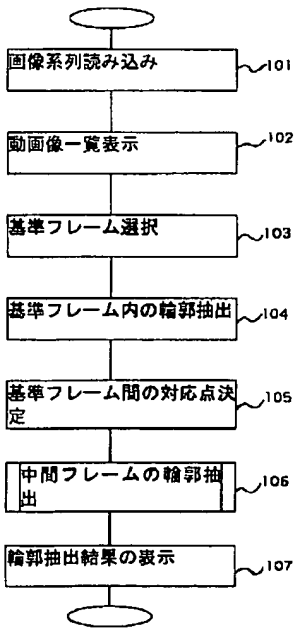
【解決手段】
ステップ１０３で、ユーザが、ディスプレイに一覧表示された複数のフレームの画像の中から、連続しない２枚の基準フレームを選択すると、ステップ１

[SOLUTION]
At step 103, a user chooses two not continuous reference frames out of the image of some frames showed by a list by the display.
At step 104, the contour_line of an objective image is respectively extracted from the image

０４で、各基準フレームの画像から物体の画像の輪郭線が各々抽出される。その後、ステップ１０５で、ユーザが、各基準フレームの画像において物体の画像の輪郭線上の特徴点を各々適当数指示し、更に、これらを相互に対応付けると、ステップ１０６で、各基準フレームの画像上の特徴点の座標から、２枚の基準フレームの間の中間フレームにおける物体の画像の輪郭線が推定される。そして、これが探索開始輪郭線とされる。そして、各中間フレームの画像において、各々、探索開始輪郭線から探索が開始され、実際の物体の画像の輪郭線が抽出される。

of each reference frame.
After that, only in a suitable number, a user indicates the distinctive point on the contour_line of an objective image respectively in the image of each reference frame at step 105, furthermore, if these are matched mutually, the contour_line of the image of the object in the intermediate frame between two reference frames will be presumed from the coordinates of the distinctive point on the image of each reference frame at step 106.
And let this be a retrieval start contour_line.
And it sets in the image of each intermediate frame, respectively, retrieval is started from a retrieval start contour_line, the contour_line of the image of an actual object is extracted.

図3



101: Read image sequence
102: List dynamic images
103: Select reference frame
104: Extract the outline in the reference frame
105: Determine the corresponding point between the reference frames
106: Extract the outline of the middle frame
107: display the outline extract result

【特許請求の範囲】

【請求項１】
複数のフレームの画像から物体の画像の輪郭線を順次抽出する画像抽出方法であって、
前複数のフレームの内の連続しない２枚の基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の指定を受け付ける第一ステップと、
前記各基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の位置に基づいて、前記２枚の基準フレームに挟まれた中間フレームの画像において前記物体の画像の輪郭線の探索を開始する探索開始線をそれぞれ算出する第二ステップと、
前記２枚の基準フレームに挟まれた中間フレームの画像において前記探索開始線から前記物体の画像の輪郭線の探索を開始し、前記物体の画像の輪郭線を順次抽出する第三ステップとを含むことを特徴とする画像抽出方法。

[CLAIMS]

[CLAIM 1]
It is the image extracting method which extracts the contour_line of an objective image from the image of some frames in order, comprised such that image extracting method characterized by including the 1st step which receives designation of some distinctive points on the contour_line of the image of said object mutually corresponded between the images of two reference frames which are not followed of some frames, the 2nd step which computes the retrieval start line which starts retrieval of the contour_line of the image of said object in the image of the intermediate frame pinched by the reference frame of said 2 sheet based on the position of some distinctive points on the contour_line of the image of said object corresponded mutually between the images of each of said reference frame, respectively, and The 3rd step which starts retrieval of the contour_line of the image of said object from said retrieval start line in the image of the intermediate frame pinched by the reference frame of said 2 sheet, and extracts the contour_line of the image of said object in order .

【請求項２】
複数のフレームの画像から物体の画像の輪郭線を順次抽出する画像抽出方法であって、
前複数のフレームの内の連続しない複数の基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の指定を受け付ける第一ステップと、
前後の基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の位置に基づいて、前後の基準フレームに挟まれた中間フレームの画像において前記物体の画像の輪郭線の探索を開始する探索開始線をそれぞれ算出する第二ステップと、
前後の基準フレームに挟まれた中間フレームの画像において前記探索開始線から前記物体の画像の輪郭線の探索を開始し、前記物体の画像の輪郭線を順次抽出する第三ステップとを含むことを特徴とする画像抽出方法。

[CLAIM 2]
It is the image extracting method which extracts the contour_line of an objective image from the image of some frames in order, comprised such that image extracting method characterized by including the 1st step which receives designation of some distinctive points on the contour_line of the image of said object mutually corresponded between the images of some reference frames which are not followed of some frames, the 2nd step which computes the retrieval start line which starts retrieval of the contour_line of the image of said object in the image of the intermediate frame pinched by the reference frame of order based on the position of some distinctive points on the contour_line of the image of said object corresponded mutually between the images of the reference frame of order, respectively, and
The 3rd step which starts retrieval of the contour_line of the image of said object from said retrieval start line in the image of the intermediate frame pinched by the reference frame of order, and extracts the contour_line of the image of said object in order
.

【請求項３】
請求項２記載の画像抽出方法であって、
前記第二ステップは、
一の基準フレームの画像に含まれる前記物体の画像の輪郭線上の複数の特徴点と、前記複数の特徴点の各特徴点に対応する前記一の基準フレームの次の基準フレームに含まれる前記物体の画像の輪郭線上の複数の特徴点との間を、それぞれ、前記一の基準フレームと前記一の基準フレームの次の基準フレームとの間に挟まれた中間フレームの数

[CLAIM 3]
It is the image extracting method of Claim 2, comprised such that said 2nd step is Image extracting method characterized by including
the step which computes the interior division point which divides Between Some distinctive points on the contour_line of the image of said object contained in the image of one reference frame, and
some distinctive points on the contour_line of the image of said object contained in the next reference frame of said one reference frame corresponded in each distinctive point of these distinctive points, into (N+1) which is the number 1 more than N which is respectively the number of the intermediate frames pinched between said one reference frames and next

であるＮよりも１多い数である（Ｎ＋１）個に分割する内分点を算出するステップと、
前記内分点の内の、前記一の基準フレームの画像に含まれる前記物体の画像の輪郭線上の複数の特徴点と、前記複数の特徴点の各特徴点に対応する前記一の基準フレームの次の基準フレームに含まれる前記物体の画像の輪郭線上の複数の特徴点との間を、Ｊ：（Ｎ－Ｊ＋１）（Ｊは、Ｎ以下の自然数）に分割している内分点の間を所定の補間関数を用いて補間して得た線を、前記一の基準フレームのＪ番目後の中間フレームの探索開始線とするステップを含むことを特徴とする画像抽出方法。

reference frames of said one reference frame, and
the step which makes the line which interpolated and obtained between the interior division points which are dividing between some distinctive points on the contour_line of the image of said object contained in the image of said one reference frame of said interior division points.
and some distinctive points on the contour_line of the image of said object contained in the next reference-standard frame of said one reference-standard frame corresponded in each distinctive point of these distinctive points
to J: (N-J +1) (J is N or less natural number) using the given interpolation function, as the retrieval start line of the intermediate frame Jth after said one reference frame.

【請求項４】
請求項３記載の画像抽出方法であって、
前記所定の補間関数は前記基準フレームの数よりも一次低次の多項関数であることを特徴とする画像抽出方法。

[CLAIM 4]
It is the image extracting method of Claim 3, comprised such that said given interpolation function is a multinominal function low-orderer the first order than the number of said standard frames.
Image extracting method characterized by the above-mentioned.

【請求項５】
請求項３記載の画像抽出方法であって、
前記所定の補間関数はスプライン関数であることを特徴とする画像抽出方法。

[CLAIM 5]
It is the image extracting method of Claim 3, comprised such that said given interpolation function is a spline function.
Image extracting method characterized by the above-mentioned.

【請求項６】
請求項１、２、３、４または５記載の画像抽出方法であって、
前記複数のフレームは、複数のカメラを用いて任意の位置と任意の方向とから前記物体を撮影したフレームにより構成される

[CLAIM 6]
It is the image extracting method of Claim 1, 2, 3, 4 or 5, comprised such that these frames are constituted from arbitrary positions and arbitrary directions by the photographed frame in said object using some cameras.
Image extracting method characterized by the above-mentioned.

ことを特徴とする画像抽出方法。

【発明の詳細な説明】

[DETAILED DESCRIPTION OF INVENTION]

【０００１】

[0001]

【発明の属する技術分野】
本発明は、動画像の中から、動きの激しい移動物体の画像の輪郭線を確実に抽出することができる画像抽出方法に関する。

[TECHNICAL FIELD]
This invention relates to the image extracting method which can extract the contour_line of the image of a rapidly moving object reliably out of a dynamic image.

【０００２】

[0002]

【従来の技術】
医療や気象学等の様々な分野で広く利用されている動画像解析においては、動画像から解析対象物の領域を抽出することが基本的な技術とされる。このような技術は、一般に画像セグメンテーション技術と呼ばれており、その一手法として、画像の特徴（例えば、明るさ等）の変化点をエッジとして検出、強調、接続することによって解析対象物の画像の輪郭線を抽出する境界検出が知られている。この境界検出に関しては、Computer Vision, Prentice-Hall, Inc. １９８２「第４章　Boundary Detection」（D.H.Ballard, C.B.Brown 著）に記載されている。以下、この種の手法に特徴的なエッジ検出について、モノクローム静止画像ｆ（ｘ，ｙ）を対象画像とした場合を例に挙げて、これに記載されているエッジ検出について説明する。

[PRIOR ART]
Let it be a fundamental technique to extract the area of an analysis target object from a dynamic image in the dynamic image analysis utilized widely in various fields, such as a medical treatment and meteorology.
Generally such a technique is called the image segmentation technique, as the way method, the changing point of the characteristics (for example, brightness etc.) of an image is detected as edge.
It emphasizes.
It connects.
The contour_line of the image of an analysis target object is thus extracted.
The limit detection is known.
This limit detection is indicated by ComputerVision, Prentice-Hall, Inc.1982"Chapter 4 BoundaryDetection" (D. H.Ballard, C.B.Brown work).
Hereinafter, about an edge detection characteristic of this kind of approach, the case where the monochrome still picture f (x y) is made into an object image is mentioned as an example, the edge detection indicated by this is demonstrated.

【０００３】
基本的には、画像中の隣接する画素間の色や画像濃度の差の大きい所をエッジとして求め、これをつなぐことにより輪郭を求める。ここで、エッジという言葉は、画像中に存在するなんらかの意味での線分であり、輪郭は画像中に存在する物体の外形を表している、物体が画像中に隠れず見えている場合には閉曲線になるものである。エッジは輪郭上にも、それ以外にも数多く存在する。また逆に、後に述べるエッジ検出オペレータのような通常の画像処理の技法では、輪郭上の全てがエッジと認定されるわけではない。

[0003]
Fundamentally, the large place of the color between the adjacent pixels in an image or the difference of an image density is calculated as edge.
An outline is caculated by connecting this.
Here, the word "edge" is a line segment in a certain meaning which exists in an image.
An outline becomes a closed curve, when the object showing the contour of the object which exists in an image does not hide into an image but is showing.
Many edge exists in an outline top and other than that.
Moreover, in the technique of a usual image processing conversely like the edge detection operator who states later, not all on an outline are recognized as edge.

【０００４】
エッジを求めるために用いられるのは次のようなものである。

[0004]
Being used since edge is calculated is as follows.

【０００５】
白黒濃淡画像の場合、ｉ，ｊ画素をａ（ｉ，ｊ）で表す。ｉ方向が横方向に、ｊ方向が縦方向に対応する。

[0005]
In the case of monochrome concentration-difference image, i and j pixels are expressed with a (i, j).
The direction of i corresponds in a horizontal direction.
The direction of j corresponds in a vertical direction.

【０００６】
（１）一次微分
横方向：a(i+1,j)-a(i,j),
縦方向：a(i,j+1)-a(i,j),
絶対値：(a(i+1,j)-a(i,j))の平方と(a(i,j+1)-a(i,j)の平方の和の平方根
など
（２）二次微分
横方向：a(i+1,j)-2a(i,j)+a(i-1,j),

[0006]
(1)
First derivation
Horizontal direction: a(i+1, j)-a (i, j), vertical direction: a(i, j+1)-a (i, j), absolute value :
The square root of the sum of Square of (a(i+1, j)-a (i, j)
(Square of a(i, j+1)-a (i, j)
etc.

(2)

縦方向：a(i,j+1)-2a(i,j)+a(i,j-1)，両方向の和：a(i+1,j)+a(i-1,j)+a(i,j+1)+a(i,j-1)-4a(i,j)など、ここで最後の両方向の和を、特に、ラプラシアンということがある。このラプラシアン∇^2は、実際には、以下に示す３行３列のオペレータを用いたコンボリューション演算によって算出される。

Second derivation
Horizontal direction: a(i+1, j)-2a(i, j)+a (i-1, j), vertical direction: a(i, j+1)-2a(i, j)+a (i, j-1), the sum of bi-directionalities :
a(i+1,j)+a(i-1,j)+a(i,j+1)+a(i,j-1)-4a(i,j)
etc.
The sum of the last bi-directionalities may be especially called Laplacian here.
This Laplacian TRIANGLE2 is computed in fact by the convolution calculation using the operator of the three-line three rows shown below.

【０００７】

[0007]

```
0  1  0
1 -4  1
0  1  0
```

即ち、ラプラシアン∇^2は、結果的として、次式のように表されることになる。

That is, Laplacian TRIANGLE2 is expressed like following Formula as consequent.

【０００８】
$\nabla^2 = a(x, y-1) + a(x-1, y) - 4a(x, y) + a(x+1, y) + a(x, y+1)$ ...（数式１）
尚、エッジ検出の際に行うコンボリューション演算に用いるオペレータとしては、必ずしも３行３列のものが用いられる訳ではなく、ｎ行ｍ列（ｎ，ｍは、自然数）のものが用いられる場合もある。

[0008]
TRIANGLE2=a(x y-1)+a(x-1, y)-4a (x y)
+ a(x+1, y)+a (x y+1)... (Numerical formula 1)
In addition, as an operator who uses for the convolution calculation performed when it is an edge detection, 3-row three column is not always used.

The thing of n row m column (n and m are a natural number) may be used.

【０００９】
ところで、このような手法により検出されたエッジは、雑音等の影響により、途切れている場

[0009]
By the way, the edge detected by such approach is interrupted under the influence of a noise etc. in many cases.

合が多い。そこで、上記Ｃｏｍｐｕｔｅｒ　Ｖｉｓｉｏｎ，Ｐｒｅｎｔｉｃｅ－Ｈａｌｌ，Ｉｎｃ．１９８２「第４章　Ｂｏｕｎｄａｒｙ　Ｄｅｔｅｃｔｉｏｎ」（D.H.Ballard, C.B.Brown 著）には、途切れたエッジを滑らかに接続するために、エッジ追跡法を用いることが記載されている（ｐ.１３１～ｐ.１３７参照)。

In order to connect the edge which interrupted to so, said Computer Vision, Prentice-Hall, and Inc.1982"Chapter 4 Boundary Detection" (D. H.Ballard, C.B.Brown work) smoothly, using the edge tracking method is indicated (p. 131-p.137 reference).

【００１０】
これ以外のエッジ検出としては、例えば、特開平７－１２１７１０号公報記載の画像セグメンテーション方法が知られている。本画像セグメンテーション方法は、上記 Computer Vision, Prentice-Hall, Inc.１９８２「第４章　Boundary Detection」（D.H.Ballard, C.B.Brown 著）記載のエッジ検出と異なり、ユーザ側から、解析対象物の画像の輪郭上の探索開始画素の指定と、エッジ探索を進める方向の指定とを受け付けることに特徴がある。これに加えて、ユーザの指示に応じて、ユーザがマウス等で描画した輪郭線をエッジとして抽出することができることも特徴がある。即ち、ユーザが意図的にエッジ探索の指針を与えることがてきる上に、エッジの接続に失敗した場合等にユーザが意図的に解析対象物のエッジを決定することができるので、任意にエッジ探索を進める場合よりも格段に効率的に且つ確実に、複雑にエッジが入り組んだ画像から解析対象物のエッジだけを自動抽出することがで

[0010]
As an edge detection of those other than this, the image segmentation method described in Unexamined-Japanese-Patent No. 7-121710 gazette is learned, for example.
This image segmentation method is different from
an edge detection described in said ComputerVision, Prentice-Hall, and Inc.1982"Chapter 4 BoundaryDetection" (D. H.Ballard, C.B.Brown work)
.
The characteristics are to receive designation of the retrieval start pixel on the outline of the image of an analysis target object, and designation of a direction that edge retrieval is advanced, from a user side.
It adds to this, according to an indication of a user, the contour_line which the user drew with the mouse etc. can be extracted as edge.
This is also characteristic.
That is, a user can give the pointer of edge retrieval intentionally.
When connection of edge goes wrong, a user can determine the edge of an analysis target object intentionally.
Therefore, only the edge of an analysis target object can be automatically extracted from the image in which edge became intricate intricately reliably markedly more efficiently than the case where edge retrieval is advanced arbitrarily.

きる。

【００１１】
ところで、動画像から解析対象物のエッジを検出する場合には、動画像を構成する全てのフレームに関して上記静止画像におけるエッジ検出と同様に手法が適用されるわけではない。膨大なデータを効率的に処理するために、通常は、「SNAKES:Active Contour Models」（M.Kess,A.Witkin,D.Terzopoulos) International Journal of Computer Vision,vol.1 No.4,1988 に記載されているように、動画像を構成するフレームの内の最初のフレームからだけは上記静止画像におけるエッジ検出と同様な手法に従って解析対象物のエッジを検出するが、その後に続くフレームに関しては、直前のフレームから抽出した解析対象物のエッジを探索開始点としてエッジ探索を行うことにより解析対象物のエッジを検出するという手法が採用されている。

[0011]
When, detecting the edge of an analysis target object from a dynamic image by the way, an approach is not used like the edge detection in said still picture about all the frames that constitute a dynamic image.
In order to process a vast quantity of data efficiently, usually, it is indicated by "SNAKES:ActiveContourModels" (M. Kess, A.Witkin, D.Terzopoulos) InternationalJournalofComputerVision, vol.1 No. 4, 1988.

Only from the frame of the beginning of the frames which constitute a dynamic image, the edge of an analysis target object is detected according to the similar approach as the edge detection in said still picture.
However, it is related with the frame which continues after that, it retrieves for edge by making into a retrieval starting point the edge of the analysis target object extracted from the last frame.
The edge of an analysis target object is detected.
The approach is adopted.

【００１２】

[0012]

【発明が解決しようとする課題】
ところが、上記動画像から解析対象物のエッジを検出する場合に採用されている手法には、動きの激しい解析対象物のエッジの検出には対処しきれないという欠点があった。即ち、解析対象物の動きが激しいと、連続す

[PROBLEM ADDRESSED]
However, the approach adopted when detecting the edge of an analysis target object from said dynamic image had the fault that a detection of the edge of the intense analysis target object of a motion could not be coped with.
There was the fault.
That is, when a motion of an analysis target object is rapid, in a continuous frame, the position of an analysis target object is remarkably different mutually in many cases.

るフレームにおいて解析対象物の位置が相互に著しく相違している場合が多いため、直前のフレームから抽出した解析対象物のエッジを探索開始点としても、必ずしも、解析対象物のエッジを検出できるとは限らないのである。

Therefore, it is also considering the edge of the analysis target object extracted from the last frame as a retrieval starting point, the edge of an analysis target object can not necessarily be detected.

【００１３】
そこで、本発明は、動画像の中から、動きの激しい移動物体の画像を確実に且つ効率的に抽出することができる動画像抽出方法を提供することを目的とする。

[0013]
Then, this invention aims at providing the dynamic image extracting method which can extract the image of a rapidly moving object reliably and efficiently out of a dynamic image.

【００１４】

[0014]

【課題を解決するための手段】
上記課題を解決するために、本発明は、複数のフレームの画像から物体の画像の輪郭線を順次抽出する画像抽出方法であって、前記複数のフレームの内の連続しない２枚の基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の指定を受け付ける第一ステップと、前記各基準フレームの画像間で相互に対応する前記物体の画像の輪郭線上の複数の特徴点の位置に基づいて、前記２枚の基準フレームに挟まれた中間フレームの画像において前記物体の画像の輪郭線の探索を開始する探索開始線をそれぞれ算出する第二ステップと、前記２枚の基準フレームに挟まれた中間フレームの画像において前記探索開始線から前記物体の

[SOLUTION OF THE INVENTION]
In order to solve said subject, this invention is image extracting method which extracts the contour_line of an objective image from the image of some frames in order.
Comprising: The image extracting method characterized by including
The 1st step which receives designation of some distinctive points on the contour_line of the image of said object mutually corresponded between the images of two reference frames which are not followed of these frames, the 2nd step which computes the retrieval start line which starts retrieval of the contour_line of the image of said object in the image of the intermediate frame pinched by the reference frame of said 2 sheet, respectively based on the position of some distinctive points on the contour_line of the image of said object mutually corresponded between the images of each of said reference frame, and
the 3rd step which starts retrieval of the contour_line of the image of said object from said retrieval start line in the image of the intermediate frame pinched by the reference

画像の輪郭線の探索を開始し、前記物体の画像の輪郭線を順次抽出する第三ステップとを含むことを特徴とする画像抽出方法を提供する。

frame of said 2 sheet, and extracts the contour_line of the image of said object in order is provided.

【００１５】

[0015]

【発明の実施の形態】
以下、添付の図面を参照しながら、本発明に係る実施の一形態について説明する。

[Embodiment]
Hereafter, one Embodiment based on this invention is demonstrated, referring attached drawing.

【００１６】
まず、図１により、本実施の形態に係る画像処理システムのハードウエアの基本構成について説明する。

[0016]
First, FIG. 1 demonstrates the basic composition of the hardware of the image-processing system based on this embodiment.

【００１７】
本画像処理システムは、ユーザからの入力を受け付ける入力装置と、デジタル動画像データをフレーム毎に入力する画像入力装置３０８と、動画像を表示するディスプレイ装置（例えば、ＣＲＴモニタや液晶ディスプレイ等）３０５と、画像入力装置３０８から入力されたデジタル動画像データや後述のセグメンテーション処理中で行う演算処理等を定義した各種プログラム等を格納する補助記憶装置３０７と、後述のセグメンテーション処理を実行するプロセッサ３０１と、プロセッサ３０１用のバッファメモリ３０２と、プロセッサ３０１用のフレームメモリ３０３と、プロセッサ３０１に補助記憶装置３０７と画像入力装置３０８と入力装置３１

[0017]
This image-processing system, the input device which receives input from a user, the image input device 308 which inputs digital dynamic image data for every frame, the display units 305 which display a dynamic image (for example, a CRT monitor, a liquid crystal display, etc.), auxiliary memory 307 which stores the digital dynamic image data input from the image input device 308, the various program which defined the arithmetic processing performed by below-mentioned segmentation being under process, the processor 301 which performs the below-mentioned segmentation process, the buffer memory 302 for processor 301, the frame memory 303 for processor 301
And input-output COP 306 which connects auxiliary memory 307, an image input device 308, and an input device 310,309 to a processor 301, the display controller 304 which converts into a RGB signal the image data stored in the frame buffer 303, and is output to a display unit 305, the system_bus 311 which connects these each part mutually
are provided.

０，３０９とを接続する入出力制御プロセッサ３０６と、フレームバッファ３０３に格納された画像データをＲＧＢ信号に変換してディスプレイ装置３０５へと出力するディスプレイコントローラ３０４と、これら各部を相互に接続するシステムバス３１１とを備える。

【００１８】
動画像を表示するディスプレイ装置３０５は、この種のディスプレイ装置として一般的とされている特性（即ち、１０００×１０００画素表示、赤青緑それぞれ２５６階調、１６７０万色表示）を有するものである。これの代わりに、これとは異なる特性を有する他のディスプレイ装置を使用する場合には、必要に応じて、現在使用している画像入出力装置３０８を、新たなディスプレイ装置の特性に対応可能な性能を有する他の画像入力装置に変更することが望ましい。

[0018]
The display unit 305 which displays a dynamic image, has the characteristic (namely, each red, blue and green a 1000*1000-pixel display, 256 gradation, a 16,700,000 color display) made general as this kind of a display unit.
When using the other display unit which has a different characteristic from this instead of this, , it is desirable to alter into the other image input device which has the capability which can correspond as required the image input output device 308 used now to the characteristic of a new display unit.

【００１９】
ユーザからの入力を受け付ける入力装置は、各キーに割り当てられた機能の選択を受け付けるキーボード３０９と、ディスプレイ装置３０５のスクリーン画面上の任意の位置の指定を受け付けるマウス３１０等から構成されている。

[0019]
The input device which receives input from a user consists of mouse 310 grades which receive designation of the arbitrary positions on the keyboard 309 which receives a choice of the function assigned to each key, and the screen screen of a display unit 305.

【００２０】
従って、ユーザは、マウス３１０を用いてディスプレイ装置３０５のスクリーン画面上に表示

[0020]
Therefore, the user moved the cursor currently displayed on the screen screen of a display unit 305 using the mouse 310,

されているカーソルを移動させた後、更に、マウス３１０に搭載されたボタン（本実施の形態では、２つのボタン）の内の所定のボタンをクリックすることにより、ディスプレイ装置３０５のスクリーン画面上に時系列に並んだ状態で一覧表示された動画像を構成する複数のフレーム（図５参照）の中から、所望のシーンを構成するフレームを指定することができる（後述）。以下、このときのユーザによるマウス操作を、「マウス３１０によるピック」と呼ぶ。また、マウス３１０に搭載されたボタンが押されている状態を「マウスＯＮ状態」と呼び、これとは逆にマウス３１０に搭載されたボタンが押されていない状態を「マウスＯＦＦ状態」と呼ぶことにする。

Furthermore, the predetermined button of the button (this embodiment two button) mounted on the mouse 310 is clicked.
From the inside of some frames (refer FIG. 5) which constitute the dynamic image showed by a list in the state where it stood in a line on the screen screen of a display unit 305 at time series, the frame which constitutes a desired scene can be designated (after-mentioned).
Hereafter, the mouse operation by the user at this time is called "the pick by the mouse 310."
Moreover, the state where the button with which a "mouse-on state", and a call and this were conversely mounted on the mouse 310 is not pressed in the state where the button mounted on the mouse 310 is pressed will be called a "mouse-off state."

【００２１】
尚、本実施の形態では、ディスプレイ装置のスクリーン画面上の位置を指定するための入力装置としてマウス３１０を使用しているが、必ずしもマウスを使用する必要はなく、マウス３１０の代用として、他のロケータ装置（例えばジョイスティック等）を使用しても構わない。また、マウス３１０の操作方法に関しても、ここで説明した通りの操作方法を採用する必要はなく、ユーザの操作性を考慮して適当な変更を加えた操作方法を採用することが望ましい。

[0021]
In addition, in this embodiment, the mouse 310 is used as an input device for designating the position on the screen screen of a display unit.
However, it is not necessary to necessarily use a mouse, as substitution of a mouse 310, it may use other locator apparatus (for example, joystick etc.).
Moreover, also about the operation method of a mouse 310, it is not necessary to adopt the operation method as demonstrated here, it is desirable to adopt the operation method which considered a user's operativity and added suitable alteration.

【００２２】
また、ユーザは、キーボード３

[0022]
Moreover, a user chooses a suitable key out of

０９のキーの中から適当なキーを選択することにより、それぞれのキーに割り当てられた数値や、プログラムの実行を指示するコマンド等を入力することができる。

the key of a keyboard 309.
The numerical value assigned to each key, the command which indicates execution of a program can be input.

【００２３】
プロセッサ３０１用のバッファメモリ３０２には、図２に示すように、システムの起動と共に所定のデータを記憶する領域、即ち、補助記憶装置３０７に格納された所定のプログラムを記憶するプログラム領域４０１と、オペレーティングシステムを構成する各種プログラムを記憶するオペレーティングシステム領域（不図示）と、後述のセグメンテーション処理において必要とされる各種データを記憶するデータ領域４０２とが確保されている。

[0023]
In the buffer memory 302 for processor 301, as shown in FIG. 2, the region 401 which stores predetermined data with starting of a system (namely, program region which stores the predetermined program stored in auxiliary memory 307), the operating-system region which stores the various program which constitutes an operating system (not shown), the data region 402 which stores the various data made necessary in the below-mentioned segmentation process
are ensured.

【００２４】
そして、プログラム領域４０１に含まれている各領域は、それぞれ、後述のセグメンテーション処理の流れを定義した全体制御プログラムを記憶する領域４０３と、後述のセグメンテーション処理中で実行される基準フレーム輪郭抽出処理を定義した基準フレーム輪郭抽出プログラムを記憶する領域４０４と、後述のセグメンテーション処理中で実行される輪郭探索処理を定義した輪郭探索プログラムを記憶する領域４０６と、後述のセグメンテーション処理中で実行される探索開始輪郭算出処理を定義した探索開始輪郭算出プロ

[0024]
And each range included to the program range 401 is assigned as
The region 403 which stores the entire control program which respectively defined the flow of the below-mentioned segmentation process, the region 404 which stores the reference-standard frame outline extraction program which defined the reference-standard frame outline extraction process performed by below-mentioned segmentation being under process, the range 406 which stores the outline retrieval program which defined the outline retrieval process performed by below-mentioned segmentation being under process.
And the range 405 which stores the retrieval start outline calculation program which defined the retrieval start outline calculation process performed by below-mentioned segmentation being under process

グラムを記憶する領域４０５として割り当てられている。

【００２５】
一方、データ領域４０２に含まれている各領域は、それぞれ、補助記憶装置３０７に格納されたデジタル動画像データ（または、画像入力装置３０８から入力されたデジタル動画像データ）を記憶する動画像データ領域４０７、後述のセグメンテーション処理中で実行される輪郭探索処理により抽出された輪郭線データを記憶する輪郭線データ領域４０８と、エッジ検出のコンボリューション演算に用いられる差動型オペレータを記憶するカーネルパタン領域４０９と、後述のセグメンテーション処理において作成される一時的なデータを記憶する作業領域４１０として割り当てられている。

[0025]
On the other hand, each range included to the data range 402 is assigned as
The moving-image data range 407 which stores the digital moving-image data (or digital moving-image data input from the image input device 308) respectively stored in auxiliary memory 307, the contour_line data range 408 which stores the contour_line data extracted by the outline retrieval process performed by below-mentioned segmentation being under process, the kernel pattern range 409 which stores the differential operator used for the convolution calculation of an edge detection.
And workspace 410 which stores temporary data created in the below-mentioned segmentation process
.

【００２６】
以上で、本実施の形態に係る画像処理システムのハードウエアの構成についての説明を終わる。尚、本実施の形態では、プロセッサ３０１とバッファメモリ３０２と入出力プロセッサ３０６とに相当する処理部として、スタンドアロン型の情報処理装置（ワークステーション、パーソナルコンピュータ）を使用しているが、必ずしも、このようにする必要はない。例えば、本画像処理システムをネットワークシステムにより構成して、後述のセグメンテーション処理等における演算処理を多数の計

[0026]
Above, the description about the composition of the hardware of the image-processing system based on this embodiment is finished.
In addition, in this embodiment, the information processor (a workstation, personal computer) of a stand-alone is used as a process part which corresponds to a processor 301, the buffer memory 302, and the input-output processor 306.
However, it is not necessary to necessarily do in this way.
For example, a network system constitutes this image-processing system, it may make parallel perform the arithmetic processing in the below-mentioned segmentation process etc. in many computer resources.
Moreover, it is not necessary to necessarily use the information processor used by this

算機資源に並列に実行させるようにしても構わない。また、必ずしも、本実施の形態で使用した情報処理装置と同種のアーキテクチャの情報処理装置、即ち、プロセッサ３０１とバッファメモリ３０２と入出力プロセッサ３０６が１本のシステムバスを共有するシングルバスアーキテクチャの情報処理装置を使用する必要もない。例えば、プロセッサ３０１とバッファメモリ３０２との間と、プロセッサ３０１と入出力プロセッサ３０６との間を、それぞれ、個別のシステムバスで接続した情報処理装置を使用しても構わない。

embodiment, and the information processor (namely, information processor of a single bus architecture with which a processor 301, the buffer memory 302, and the input-output processor 306 share one system_bus) of the architecture of a same.
For example, it may use the information processor which connected between a processor 301 and the input-output processors 306 by the respectively separate system_bus between a processor 301 and the buffer memories 302.

【００２７】
以下、図３、図４により、プロセッサ３０１が、バッファメモリ３０２の領域４０３に記憶された全体制御プログラムに従って実行するセグメンテーション処理について説明する。

[0027]
The segmentation process which a processor 301 performs by FIG. 3, FIG. 4 hereafter according to the entire control program which the range 403 of the buffer memory 302 stored is demonstrated.

【００２８】
ユーザが入力装置を用いて所定のコマンドを入力すると、図３に示したセグメンテーション処理が開始される。即ち、ステップ１０１において、補助記憶装置３０７に格納されているデジタル動画像データ（または、画像入力装置３０８から入力されたデジタル動画像データ）がバッファメモリ３０２の動画像データ領域４０７に記憶されると、ディスプレイコントローラ３０４は、このときバッファメモリ３０２の動画像データ領域４０７に記憶されたデジタル動

[0028]
If a user inputs a predetermined command using an input device, the segmentation process shown in FIG. 3 will be started.
That is, in step 101, if the moving-image data range 407 of the buffer memory 302 stores the digital moving-image data (or digital moving-image data input from the image input device 308) stored in auxiliary memory 307, the display controller 304 performed the predetermined image processing to the digital moving-image data which the moving-image data range 407 of the buffer memory 302 stored at this time.
This is stored in a frame buffer 303.
And after converting into a RGB signal the digital moving-image data stored in the frame buffer 303, it outputs to a display unit 305.

画像データに所定の画像処理を施した後、これをフレームバッファ３０３に格納する。そして、フレームバッファ３０３に格納されたデジタル動画像データをＲＧＢ信号に変換した後、ディスプレイ装置３０５へと出力する。

【００２９】
その結果、ステップ１０２において、ディスプレイ装置３０５のスクリーン画面上には、図５に示すように、動画像を構成するフレームの画像が時系列に並んだ状態で一覧表示される。尚、必ずしも、動画像を構成する全フレームの画像を表示する必要はなく、例えば、比較的動きの鈍い物体を主な被写体としている場合であれば、数フレーム毎の画像を一覧表示するようにしても構わない。

[0029]
Consequently, it sets to step 102, on the screen screen of a display unit 305, the image of the frame which constitutes a dynamic image is showed by a list in the state where it ranked with time series, as shown in FIG. 5.
In addition, it is not necessary to necessarily display the image of all the frames that constitute a dynamic image, for example, as long as it is the case where the blunt body of a motion is being comparatively used as the main photographed objects, it may show the image in every several frames by a list.

【００３０】
その後、ステップ１０３において、ユーザが、「マウス３１０によるピック」で、ディスプレイ装置３０５のスクリーン画面上に一覧表示されたフレームの画像の中から、所望のシーンの先頭フレームF_1と末尾フレームＦｎの画像とをそれぞれ指定すると、このとき指定された先頭フレームF_1と末尾フレームＦｎが、基準フレームとして設定される。その後、ステップ１０４において、プロセッサ３０１は、バッファメモリ３０２の領域４０４に記憶された基準フレーム輪郭抽出処理プログラムに従って、基準フレーム輪郭抽出

[0030]
After that, in step 103, if a user designates head frame F1 of a desired scene, and the image of the end frame Fn with "the pick by the mouse 310", respectively out of the image of the frame showed by a list on the screen screen of a display unit 305, head frame F1 and the end frame Fn which were designated at this time are set up as a reference-standard frame.
After that, in step 104, a processor 301 performs a reference-standard frame outline extraction process according to the reference-standard frame outline extraction processing program which the range 404 of the buffer memory 302 stored, that is, the edge detection demonstrated in the column of a PRIOR ART is performed using the differential operator whom the kernel pattern range 409 of the buffer memory 302 stored, the contour_line of the image of Object B is extracted from two

処理、すなわち、バッファメモリ３０２のカーネルパタン領域４０９に記憶された差動型オペレータを用いて、従来技術の欄で説明したエッジ検出を実行し、２枚の基準フレームF_1，Ｆｎの画像から物体Ｂの画像の輪郭線をそれぞれ抽出する。尚、基準フレーム輪郭抽出処理は、必ずしも、従来技術の欄で説明したエッジ検出による必要はなく、例えば、セグメンテーション技術の他の一手法として知られている領域分割等であっても構わない。そして、２枚の基準フレームF_1，Ｆｎの画像から抽出した物体Ｂの画像の輪郭線を表す輪郭線データをバッファメモリ３０２の輪郭線データ領域４０８にそれぞれ記憶しておく。その後、ディスプレイコントローラ３０４は、２枚の基準フレームF_1，Ｆｎの画像から抽出された物体Ｂの画像の輪郭線を表す輪郭線データと、２枚の基準フレームF_1，Ｆｎの画像を表す画像データとをそれぞれ合成した後、ステップ１０２と同様な処理を施して、ディスプレイ装置３０５へと出力する。その結果、ディスプレイ装置３０５のスクリーン画面上には、新たに抽出した物体Ｂの画像の輪郭線B_1，Ｂｎを合成表示した基準フレームF_1，Ｆｎの画像が表示される。

reference-standard frames F1 and the image of Fn, respectively.
In addition, a reference-standard frame outline extraction process does not necessarily need to be based on the edge detection demonstrated in the column of a PRIOR ART, for example, it may be the range division known as another way method of a segmentation technique.
And two reference-standard frames F1 and the contour_line data showing the contour_line of the image of the object B extracted from the image of Fn are stored to the contour_line data range 408 of the buffer memory 302, respectively.
After that, the display controller 304 synthesized two reference-standard frames F1, the contour_line data showing the contour_line of the image of the object B extracted from the image of Fn, and two reference-standard frames F1 and the image data showing the image of Fn, respectively.
The similar process as step 102 is performed, and it outputs to a display unit 305.
Consequently, on the screen screen of a display unit 305, reference-standard frame F1 which carried out the synthesis display of the contour_lines B1 and Bn of the image of the newly extracted object B, and the image of Fn are displayed.

【００３１】
その後、ステップ１０５において、図６に示すように、ユーザが、「マウス３１０によるピック」で、２枚の基準フレームF_1，

[0031]
After that, in step 105, as shown in FIG. 6, a user respectively indicates the contour_line B1 of the image of Object B, the distinctive point on Bn (A1, ***, An), and (N1, ***, Nn) in two

Ｆｎの画像において、それぞれ、物体Ｂの画像の輪郭線$Ｂ_1$，Ｂｎ上の特徴点（$Ａ_1$，・・・，Ａｎ），（$Ｎ_1$，・・・，Ｎｎ）を適当な個数（ｎ－１）だけ指示して、各特徴点（$Ａ_1$，$Ｎ_1$），・・・，（Ａｎ，Ｎｎ）を相互に対応付けると、ステップ１０６において、プロセッサ３０１は、図４に示した再帰的処理を実行して、２枚の基準フレーム$Ｆ_1$，Ｆｎの間の中間フレーム$Ｆ_3$，・・・，Ｆｎ－１の画像から、順次、物体Ｂの画像の輪郭線を抽出する。すなわち、プロセッサ３０１は、順次、各中間フレーム$Ｆ_2$，・・・，Ｆｎ－１の画像を処理対象画像として、以下の処理を実行する。

reference-standard frames F1 and the image of Fn with "the pick by the mouse 310" by a suitable number of objects (n-1), if each distinctive point (A1, N1), ***, and (An, Nn) are matched mutually, in step 106, a processor 301 performs the recursive process shown in FIG. 4, the contour_line of the image of Object B is extracted sequentially from two reference-standard frames F1, the intermediate frame F3 between Fn(s), ***, and the image of Fn-1.
Namely, a processor 301 performs the following processes in order by making the image of each intermediate frame F2, ***, Fn-1 into a process-target image.

【００３２】
まず、ステップ２０１において、プロセッサ３０１は、バッファメモリの領域４０５に記載された探索開始輪郭算出プログラムに従って探索開始輪郭算出を実行して、新たな処理対象であるｋ番目の中間フレームＦｋの画像に含まれる物体Ｂの輪郭線上の各特徴点$Ｋ_1$，・・・，Ｋｎの座標を推定し、更に、推定した各特徴点$Ｋ_1$，・・・，Ｋｎの間をデジタル線分描写し、これを、中間フレームＦｋの画像において、物体Ｂの輪郭線を探索する起点とすべき探索開始輪郭線７０２とする（図７参照）。具体的には、以下に示すように、まず、数式２に従って、ｋ番目の中間フレームＦｋの画像に含まれる物体Ｂの輪郭上の各特徴点$Ｋ_1$，・・・，Ｋｎの位置を表す座標（Ｘｔ，Ｙｔ）（但し、１＜ｔ

[0032]
First, in step 201, a processor 301 performs retrieval start outline calculation according to the retrieval start outline calculation program indicated to the range 405 of a buffer memory, the coordinates of each distinctive point K1 on the contour_line of the object B contained in the image of the k-th intermediate frame Fk which is a new process target, ***, and Kn are presumed, furthermore, the digital line-segment description of between each presumed distinctive point K1, ***, and Kn(s) is carried out, this is made into the retrieval start contour_line 702 which should be made the origin which retrieves for the contour_line of Object B in the image of an intermediate frame Fk.
(Refer FIG. 7).
Specifically, as shown in the following, first, according to Numerical formula 2, the coordinates (Xt, Yt) (however, 1<t<n) showing each distinctive-point K1,***,Kn position on the outline of the object B contained in the image of the k-th intermediate frame Fk are presumed.

＜ｎ）を推定する。

【００３３】
（Ｘｔ，Ｙｔ）＝｛（ｎ－ｋ）（Ｘ′ｔ，Ｙ′ｔ）＋（ｋ－１）（Ｘ″ｔ，Ｙ″ｔ）｝／（ｎ－１）　…（数式２）
ここで、（Ｘ′ｔ，Ｙ′ｔ）及び（Ｘ″ｔ，Ｙ″ｔ）（但し、１＜ｔ＜ｎ）は、２枚の基準フレームＦ$_1$，Ｆｎの画像に含まれている物体Ｂの輪郭間で相互に対応する各特徴点（Ａ$_1$，Ｎ$_1$），・・・，（Ａｎ，Ｎｎ）の位置を表す座標である。

[0033]
(Xt, Yt) ={(n-k) (X't, Y't)+ (k-1) (X"t, Y"t)}/(n-1)... (Numerical formula 2)
here (X't, Y't) (X"t, Y"t) (however, 1<t<n)is are the coordinates showing each distinctive-point (A1,N1),***,(An,Nn) position which corresponds mutually between two reference-standard frames F1 and the outline of the object B contained in the image of Fn.

【００３４】
更に、２つの基準フレームＦ$_1$，Ｆｎの画像において、それぞれ、エッジ検出により、隣接する特徴点（Ａｓ，Ａｓ－１），（Ｎｓ，Ｎｓ－１）の間にある輪郭線Ｂ$_1$，Ｂｎ上の点ＡＡｓ，ＮＮｓを抽出し、この２点ＡＡｓ，ＮＮｓの座標と、数式２とを用いて、ｋ番目の中間フレームＦｋの画像において、物体ｂの画像の輪郭線上の、隣接する特徴点Ｋｓ，Ｋｓ－１の間にある点（以下、中間点と呼ぶ）の座標を推定する。そして、このような処理を繰り返して、信頼性の高い探索開始輪郭線を作成するために充分な個数の中間点の座標を推定する。尚、本実施の形態では、隣接する特徴点Ｋｓ，Ｋｓ－１の間隔等を考慮して、隣接する特徴点Ｋｓ，Ｋｓ－１の間毎に、７個の中間点を推定した。

[0034]
Furthermore, it sets in two reference-standard frame F1 and the image of Fn, an edge detection respectively extracts contour_line B1,Bn point AAs,NNs which exists between adjacent distinctive-point (As,As-1),(Ns,Ns-1), it sets in the image of the k-th intermediate frame Fk using the coordinates of these two points AAs and NNs, and Numerical formula 2, the coordinates of the point (it is hereafter called an intermediate point) between adjacent distinctive-point Ks,Ks-1 on the contour_line of the image of Object b are presumed.
And such a process is repeated, in order to create the high retrieval start contour_line of reliability, the coordinates of the intermediate point of sufficient number of objects are presumed.
In addition, in this embodiment, the adjacent distinctive-point Ks,Ks-1 spacing etc. was considered, and the 7-piece intermediate point was presumed every between adjacent distinctive-point Ks,Ks-1.

【００３５】

[0035]

その後、ＤＤＡ（digital differential analyzer)アルゴリズム等の周知のデジタル線分描写アルゴリズムに従って、推定した特徴点K_1,・・・，Ｋｎと中間点との間をそれぞれ描画して、これを、ｋ番目の中間フレームＦｋの画像における探索開始輪郭７０２とする（図７参照)。尚、ここで一例として挙げたＤＤＡアルゴリズムは、離散点の間をデジタル的に描画するアルゴリズムとしては、最も単純なアルゴリズムであり、その詳細については、Computer Graphics-principles and practice-,Addison-Wesley 1990 J.D.Foley 他３名著（p73 ～ p74 ）に記載されている。

After that, according to a digital line-segment description algorithm with a known DDA (digitaldifferentialanalyzer) algorithm etc., between the distinctive points K1, ***, Kn(s), and the intermediate points which were presumed is drawn, respectively, let this be the retrieval start outline 702 in the image of the k-th intermediate frame Fk (refer FIG. 7).
In addition, the DDA algorithm mentioned as an example here is simplest algorithm as an algorithm which draws between detachment disseminations digitally.
The detail is indicated by ComputerGraphics-principlesandpractice- and Addison-Wesley1990J.D.Foley et al. three-persons work (p73-p74).

【００３６】
その後、プロセッサ３０１は、ステップ２０２において、バッファメモリの領域４０６に記憶された輪郭探索プログラムに従って輪郭探索処理を実行する。即ち、ｋ番目の中間フレームＦｋの画像において、ステップ２０１で算出した探索開始輪郭７０２上に適当な間隔毎に設定した探索開始点を一の起点としてエッジ検出を実行することにより、ｋ番目の中間フレームＦｋの画像から、実際の物体Ｂの画像の輪郭線Ｂｋ上に実在する点を抽出する。尚、このとき実行するエッジ検出としては、例えば、従来技術の欄で説明した「 SNAKES:Active Contour Models 」（M.Kass,A.Witkin,D,Terzopoulos) Intwernational Journal of

[0036]
After that, a processor 301 is set to step 202, an outline retrieval process is performed according to the outline retrieval program which the area 406 of a buffer memory stored.
That is, it sets in the image of the k-th intermediate frame Fk, the point which exists really the retrieval starting point set up for every interval suitable on the retrieval start outline 702 computed at step 201 on the contour_line Bk of the image of the actual object B from the image of the k-th intermediate frame Fk by performing an edge detection as one origin is extracted.
In addition, what is sufficient is just to adopt the approach in which an approach etc. is known, as an edge detection performed at this time like "SNAKES:ActiveContourModels" (M. Kass, A.Witkin, D, Terzopoulos) IntwernationalJournalofComputerVision explained in the column of a PRIOR ART, vol.1 No. 4, and the edge retrieval method indicated by 1988, for example.
And a respectively similar process is performed about all retrieval starting points, the point which exists really on the contour_line of the

ComputerVision,vol.1 No.4,1988 に記載されているエッジ探索方法と同様に手法等の周知の手法を採用すればよい。そして、全探索開始点について、それぞれ、同様な処理を実行して、物体Ｂの輪郭線の画像の輪郭線上に実在する点を順次抽出する。そして、ＤＤＡ（digital differential analyzer)アルゴリズム等の周知の描画アルゴリズムに従って、抽出した点の間を描画し、これを、ｋ番目の中間フレームＦｋの画像に含まれる物体Ｂの輪郭線の画像の輪郭線Ｂｋ（図７参照）とする。そして、この輪郭線Ｂｋを表す輪郭線データをバッファメモリ３０２の輪郭線データ領域４０８に記憶しておく。

image of the contour_line of Object B is extracted in order.
And between the extracted points is drawn according to known drawing algorithms, such as a DDA (digitaldifferentialanalyzer) algorithm, let this be the contour_line Bk of the image of the contour_line of the object B contained in the image of the k-th intermediate frame Fk (to refer FIG. 7).
And the contour_line data showing this contour_line Bk are stored to the contour_line data range 408 of the buffer memory 302.

【００３７】
さて、プロセッサ３０１が、図２に示した再帰的処理を実行して、全ての中間フレームF_2,・・・，Ｆｎ－１から、それぞれ、物体Ｂの輪郭線の画像の輪郭線B_3,・・・，Ｂｎ－１を抽出し終えたら、ステップ１０７において、ディスプレイコントローラ３０４は、バッファメモリ３０２の輪郭線データ領域４０８に記憶されている各フレームF_1,・・・，Ｆｎの画像から抽出された物体Ｂの画像の輪郭線を表す輪郭線データと、各F_1,・・・，Ｆｎの画像を表す画像データとをそれぞれ合成した後、ステップ１０２と同様な処理を施して、ディスプレイ装置３０５へと出力する。その結果、ディスプレイ装置３０５の

[0037]
Now, a processor 301 performs the recursive process shown in FIG. 2, if it respectively finishes extracting contour_line B3,***,Bn-1 of the image of the contour_line of Object B from all intermediate-frame F2,***,Fn-1, in step 107, the display controller 304 synthesized the contour_line data showing the contour_line of the image of the object B extracted from each frame F1,***,Fn image which the contour_line data range 408 of the buffer memory 302 stores, and the image data showing each F1,***,Fn image, respectively.
The similar process as step 102 is performed, and it outputs to a display unit 305.
Consequently, on the screen screen of a display unit 305, each frame F1,Fn image to which contour_line B1,***,Bn of the image of Object B was synthesized is showed by a list in the state where it ranked with time series.

スクリーン画面上には、物体Bの画像の輪郭線B_1，・・・，Bnが合成された各フレームF_1，Fnの画像が時系列に並んだ状態で一覧表示される。

【００３８】
このように、２枚の基準フレームの画像に含まれる物体の画像の輪郭線から、中間フレームの画像に含まれる物体の画像の輪郭線を推定し、これを各中間フレームの画像における探索の起点としているため、図７に示すように、各中間フレームの画像においては、それぞれ、実際の物体の画像の輪郭線の極く近傍の位置から探索を開始することができる。即ち、動きの激しい物体であっても、その画像の輪郭線を効率的に且つ確実に抽出することができる。

[0038]
Thus, the contour_line of the image of the object contained in the image of an intermediate frame is presumed from the contour_line of the image of the object contained in the image of two reference-standard frames, this is made into the origin of the retrieval in the image of each intermediate frame.
Therefore, as shown in FIG. 7, in the image of each intermediate frame, retrieval can be started from the very neighbouring position of the contour_line of the image of a respectively actual object.
That is, even if it is a rapidly moving object, the contour_line of the image can be extracted efficiently and reliably.

【００３９】
以上で、本実施の形態に係るセグメンテーション処理についての説明を終わる。

[0039]
Above, the description about the segmentation process based on this embodiment is finished.

【００４０】
尚、本実施の形態では、２枚のフレームを基準フレームとして設定しているが、必ずしも、このようにする必要はない。例えば、物体の運動が変化するような場合には、中間フレームの中に更に基準フレームを設定し、物体の運動に規則性のあるシーン毎に上記セグメンテーション処理を実行するようにしても構わない。

[0040]
In addition, in this embodiment, two frames are set up as a reference-standard frame.
However, it is not necessary to necessarily do in this way.
For example, when an objective movement changes, a reference-standard frame is further set up into an intermediate frame, it may perform said segmentation process for each existing scene regular to objective movement.

【００４１】

[0041]

また、本実施の形態では、物体の画像の輪郭線と探索開始輪郭を算出する際にＤＤＡアルゴリズムによる描画を利用しているが、必ずしも、これを利用する必要はなく、例えば、スプライン曲線をデジタル的に描画するデジタル線形描画アルゴリズムを利用しても構わない。３枚以上の基準フレームを設定する場合には、基準フレームの枚数よりも次数が一次低い適当な多項関数を作成し、これを補間関数として利用するようにしても構わない。

Moreover, in this embodiment, when calculating the objective contour_line and objective search start outline of an image, drawing by the DDA algorithm is utilized.
However, it is not necessary to necessarily utilize this, for example, it may utilize the digital linear drawing algorithm which draws a spline curve digitally.
When three or more standard frames are set up, the order produces a suitable multinominal function low the first order rather than the number of sheets of a standard frame, it may make it utilize this as an interpolation function.

【００４２】
尚、動画像は、例えば、複数のカメラを用いて異なる位置と異なる方向とから同一物体を同時に撮影し、これを合成して作成したようなものであっても構わない。

[0042]
In addition, as for dynamic image, it may image the same object simultaneously from a different direction from a different position using some cameras, this is synthesized.
What was thus produced may be used.

【００４３】

[0043]

【発明の効果】
本発明に係る動画像抽出方法によれば、動画像から、動きの激しい物体の画像の輪郭線を効率的に且つ確実に抽出することができる。

[EFFECT OF THE INVENTION]
According to the moving-image extracting method based on this invention
the contour_line of the image of a rapidly moving object can be extracted from a dynamic image efficiently and reliably.

【図面の簡単な説明】

[BRIEF EXPLANATION OF DRAWINGS]

【図１】
本発明の実施の形態に係る画像処理システムのハードウエアの基本構成を示した図である。

[FIG.1]
It is the figure which showed the basic composition of the hardware of the image-processing system based on the embodiment of this invention.

【図２】
図１のバッファメモリのデータ空間の論理的構成を示した図である。

[FIG.2]
It is the figure which showed the logical structure of the data space of the buffer memory of FIG. 1.

【図３】
本発明の実施の形態に係るセグメンテーション処理の流れを示したフローチャートである。

[FIG.3]
It is the flowchart which showed the flow of the segmentation process based on the embodiment of this invention.

【図４】
中間フレームにおける輪郭線抽出処理の流れを示したフローチャートである。

[FIG.4]
It is the flowchart which showed the flow of the contour_line extraction process in an intermediate frame.

【図５】
動画像を構成するフレームの画像を示した図である。

[FIG.5]
It is the figure which showed the image of the frame which comprises a dynamic image.

【図６】
基準フレームの画像間で対応する特徴点を示した図である。

[FIG.6]
It is the figure which showed the distinctive point which corresponds between the images of a standard frame.

【図７】
中間フレームにおける輪郭線探索処理を説明するための図である。

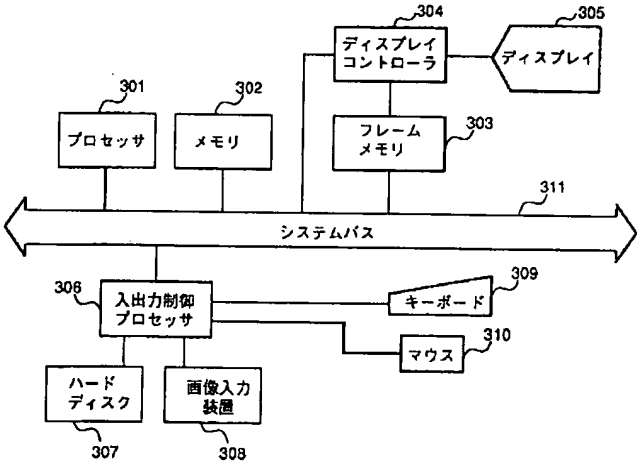
[FIG.7]
It is a figure for demonstrating the contour_line search process in an intermediate frame.

【符号の説明】
３０１…プロセッサ
３０２…バッファメモリ
３０３…フレームメモリ
３０４…ディスプレイコントローラ
３０５…ディスプレイ装置
３０６…入出力制御プロセッサ
３０７…補助記憶装置
３０８…画像入力装置
３０９…キーボード
３１０…マウス
３１１…バス

[EXPLANATION OF DRAWING]
301... a processor
302... a buffer memory
303... a frame memory
304... a display controller
305... a display unit
306... the input-output COP
307... auxiliary memory
308... an image input device
309... a keyboard
310... a mouse
311... a bus

【図１】 [FIG.1]

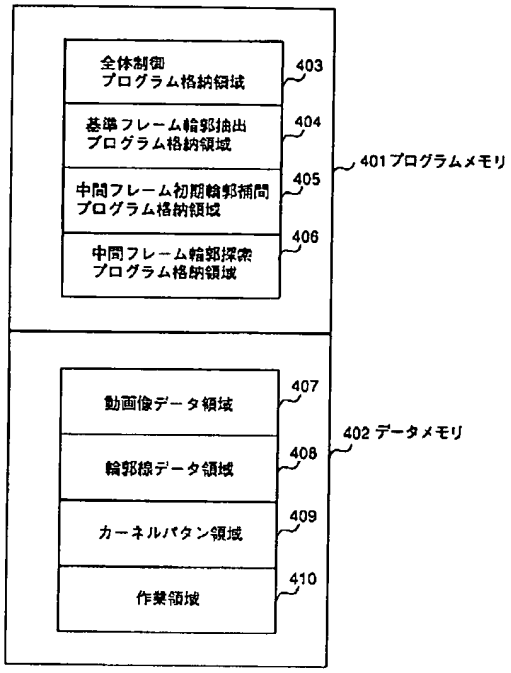
図１



301: processor
302: memory
303: frame memory
304: display controller
305: display
306: input-output control processor
307: hard disk
308: image input device
309: key board
310: mouse
311: system bus

【図２】 [FIG.2]

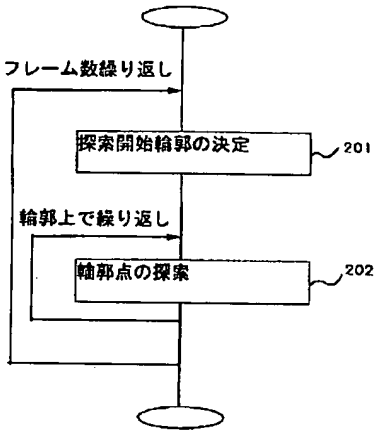
図2



401: program memory
403: the whole control program stored region
404: reference frame outline extraction program stored region
405: middle frame initial outline interpolation program stored region
406: middle frame outline retrieval program stored region
402: data memory
407: dynamic image data region
408: outline data region
409: Kernel pattern region
410: workplace

【図４】 **[FIG.4]**

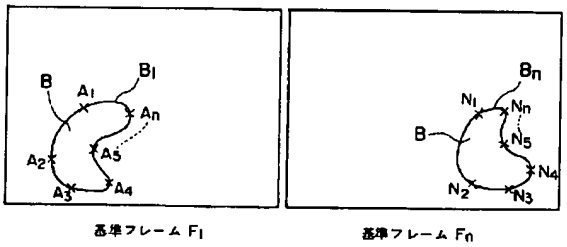
図4



Frame number repeat
201: determine retrieval outline
202: retrieve outline points
repeat on the outline point

【図６】 **[FIG.6]**

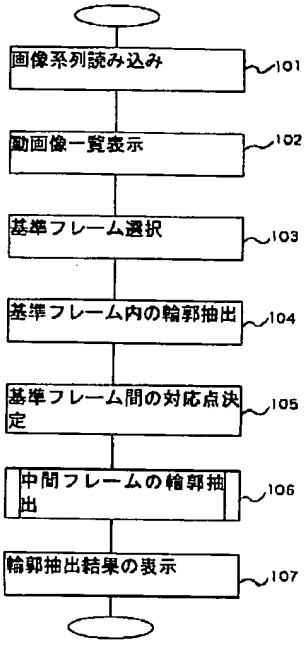
図 6



reference frame F1, Reference frame Fn

【図３】 **[FIG.3]**

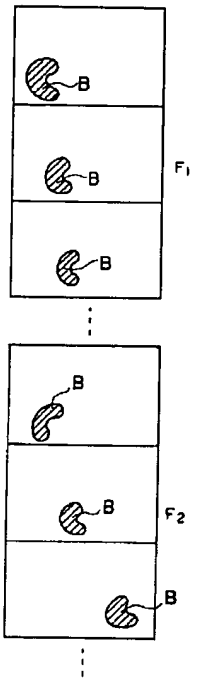
図3



101: Read image sequence
102: List dynamic images
103: Select reference frame
104: Extract the outline in the reference frame
105: Determine the corresponding point between the reference frames
106: Extract the outline of the middle frame
107: display the outline extract result

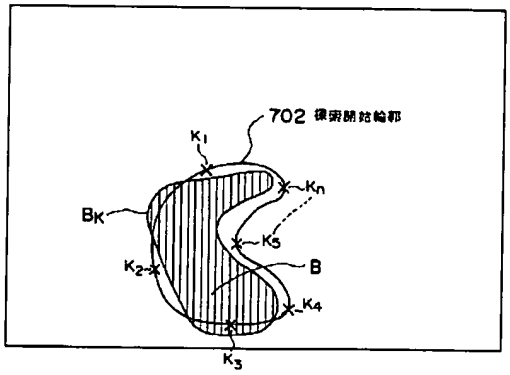
【図５】 **[FIG.5]**

図 5



【図 7】 [FIG.7]

図 7



中間フレーム FK

702: Retrieval starting outline
Middle frame Fk

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